

Developing a community of practice on education for sustainable development: first steps towards the design of a storyboard

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Abstract

This study is part of a research project that aims to develop an online Community of Practice (CoP) to promote Education for Sustainable Development (ESD) in the Portuguese context. Its potential members (teachers, pupils, parents, researchers and others) will collaborate in order to develop educational resources, to develop and share innovative teaching and learning strategies underlying an ESD approach, and help national school projects to implement an ESD approach. The aim of this paper is to present the first phase of the project: to collect the perceptions of a multidisciplinary team of researchers, who have different competences, about the principles that help to develop and sustain a CoP in the scope of ESD. Through a design-based research approach, the main technical and educational guidelines that emerged from a focus group survey will be presented. Some of the main key ideas discussed were (i) the need to be supported with the provision of teacher training and consultancy services, (ii) the identification of teachers that are already leaders in their own schools, and that could assume the leadership of this CoP, and (iii) the importance of opening the community up to other type of users, with different possibilities of access and interaction.

Keywords: Collaborative Work, Community of Practice, Design-Based-Research, Education for Sustainable Development

1 Introduction

The United Nations Educational, Scientific and Cultural Organization (UNESCO) embraced the Decade of Education for Sustainable Development (ESD) from 2005 to 2014. One of the main aims of this initiative is to prepare all citizens (teachers, pupils, parents) to face the social, economic and environmental challenges of the present world (UNESCO, 2005). The ESD approach demands a reorientation of Education through a multi- and inter-disciplinary examination of science-technology-society (STS) interrelations, and teachers are key elements in this context, where teachers should develop socio-constructivist teaching activities in order to promote critical reflection, between pupils, about cultural, social, environmental and economical issues of the current society (Aikenhead, 2006).

Nevertheless, the insufficient dissemination initiatives of research findings of ESD research projects in educational contexts, as well as the small number of teacher training courses in this field, could explain the reduced impact of research knowledge on teachers' thinking and practice in the scope of ESD (Sá, 2008). Furthermore, researchers' lack of consciousness of the reality of educational fieldwork conditions compromise teachers' involvement in research and vice-versa (E. Wenger, McDermott, & Snyder, 2002). Therefore, it is crucial to increase the articulation between research and practice, through collaborative work between teachers and researchers, and between them and the educational community (pupils, parents, and others), without differentiating the performers of research knowledge and those of educational practices.

Higher education institutions could create educational conditions in order to develop teachers' professional profiles and help them integrate innovative teaching strategies and improve their research competences. These educational conditions should balance the empowerment of teachers, pupils, parents and researchers in relation to the management of educational knowledge production of ESD (UNESCO, 2009).

The integration of information and communication technologies (ICT) in the teaching and learning process could help promote the discussion, reflection and debate of ideas about ESD among educational community actors. For instance, Web 2.0 tools could allow teachers sharing educational resources, as well as teaching guides, supporting the co-construction of knowledge in the scope of the ESD approach (UNESCO, 2009), where Communities of Practice (CoP) developed in a virtual environment (online CoP) could be a promising way for promoting ESD teaching and learning strategies. An online CoP allows to support interaction between its members in a variety of formats, encouraging the sharing of teaching and learning experiences and the co-construction of knowledge (2004).

This study is based on the assumption that it is important to develop an online CoP organized by several educational actors (researchers, teachers, pupils, parents, others). Potential members could collaborate in order to develop and share innovative ESD teaching and learning strategies and resources to help national school projects to implement an ESD approach.

Adopting a design-based research approach, an online platform is being developed based on the principles which help develop and sustain an online CoP (Wenger, 2000) in the scope of ESD (UNESCO, 2009). A focus group interview with researchers who have different competences in research and development of projects related to ESD was implemented in order to unveil which principles could help develop and sustain an online CoP in the scope of ESD. A complete description of the research methodology as well as preliminary results obtained so far will be developed further in this paper.

2 Theoretical framework

The following section will be focused on the key elements of an ESD approach as well as guidelines for designing an online CoP in this field.

2.1 Education for Sustainable Development

United Nations defines the vision for the future as embracing “common values of solidarity, equality and mutual respect between people, countries and generations, (...) characterized by sustainable development, including economic vitality, justice, social cohesion, environmental protection and the sustainable management of natural resources, so as to meet the needs of the present generation without compromising the ability of future generations to meet their needs” (United Nations, 2005, p. 1).

Education is recognized as a human right, as well as a “prerequisite for achieving sustainable development and an essential tool for good governance, informed decision-making and the promotion of democracy” (United Nations, 2005, p. 1). Therefore, it is assumed that ESD can help translate the vision mentioned before into reality.

The concept of ESD adopted by the United Nations was firstly mentioned in Agenda 21, the first international document to identify education as an essential tool for achieving sustainable development and highlight areas of action for education. From the concept of ESD, four overarching goals were put forth: to promote and improve the quality of education; reorient the curricula; raise public awareness of the concept of sustainable development; train the workforce, enabling them to adopt sustainable modes of production and consumption (UNESCO, 2009). To achieve these goals the United Nations Decade of Education for Sustainable Development (2005–2014) created the Decade for Education for Sustainable Development (DESD), emphasizing the role of education and learning.

UNESCO (2009, p. 21) refers that sustainable development (SD) and ESD require to rethink the principles on which the education system is based (UNESCO, 2009, p. 22) and identifies that there is a lack of ESD projects implementation in schools. The main reasons for that evidence are: insufficient teachers' preparation to address the interdisciplinary and holistic nature of ESD; absence of an agreed definition for ESD which led to a confusion about understanding the difference between environmental education and ESD; institutional, legislative and policy frameworks requiring adaptation to the needs of ESD; the lack of ESD teaching tools and research; and the need to strengthen the involvement of civil society in governance at multiple levels (e.g., school, community, region, country) (UNESCO, 2009, p. 22). In this view, UNESCO (2009) presents four principles for enhancing ESD processes within the educational community. These include processes for:

- 1) Collaboration and dialogue: ESD implies citizens' participation in sustainable development and their problem-solving capacity through processes which enable collaboration and dialogue between multi-stakeholders (i.e. teachers, parents, pupils, others) in order to increase learning for sustainable development;
- 2) Engaging the 'whole system': institutions and organizations have a crucial role for facilitating learning processes in the scope of ESD, and it is vital to develop synergies across schools, communities and universities in order to enhance the quality of education;
- 3) Developing innovate curriculum as well as teaching and learning experiences: the ESD approach seeks to promote this transformation in how it engages with educational systems and practices;
- 4) Improving active and participatory learning: formal, informal and non-formal “initiatives” could enlarge the interactions and debates about educational research and practices of teachers in ESD.

Within the strategies for moving forward on the DESD, research and innovation as well as the use of ICT were in fact identified (United Nations, 2005). ICT help promote the discussion, reflection and debate of ideas, as well as the sharing and co-construction of knowledge about ESD. United Nations(2005), referring to the particular links and implications that ICT have with ESD, identifies the following: 1) "ICTs are central to basic knowledge economies where wealth is generated by the transfer and use of information in ways that use fewer natural resources"; 2) "ICTs offer new learning modes and spaces"; 3) "Where ICTs are accessible to learners, they can serve to provide spaces for global dialogue"; 4) "Foster life-long learning skills in that students search for and find information, sort it for relevance, ask questions and synthesize, thus learning to be independent learners" (United Nations, 2005, p. 21). ICT is fundamental to establish and maintain active participatory learning between all the participants (teachers, researchers, designers, pupils).

2.2 Online Communities of Practice

The need to constitute communities as places of learning and joint construction of knowledge related to professional practice are eluded by several authors, such as Shulman and Shulman (2004) among others, as spaces to establish the link between individual and collective dimensions, by interaction and mutual influence (Martins, 2007). Communities of practice (CoP) participation could be a way to enhance learning in a social process interaction (Hildreth & Kimble, 2004; Lave & Wenger, 1996; E. Wenger, 1999).

Wenger (1999) refers that "Communities of Practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (E. Wenger, et al., 2002, p. 4). Wenger (2000) characterizes CoP in three main aspects: 1) they focus on shared interests; 2) its members interact and learn together by engaging in joint activities and discussions, help each other and share information; 3) develops a shared collection of experiences, stories, best practices, and ways of solving problems. Lave and Wenger (1996) propose the CoP participation as a way to enhance learning and to acquire knowledge, in a social process. Participating in a CoP, people can learn together, becoming involved and adopting different degrees of involvement in the community (Hildreth & Kimble, 2004; Lave & Wenger, 1996; E. Wenger, 1999). In this view, online communities could be a way to aggregate people who interact around ESD shared interests.

2.2.1 Sustainability of Online Communities of Practice

The sustainability of a community is started immediately after its launch (Martins, 2007). Wenger *et al.* (2002) propose seven principles that should constitute ways of thinking, visions or directions to underpin the design of the CoP, such as: 1) Design for Evolution; 2) Open a Dialog Between Inside and Outside Perspectives; 3) Invite Different Levels of Participation; 4) Develop Both Public and Private Community Spaces; 5) Focus on Value; 6) Combine Familiarity and Excitement; 7) Create a Rhythm for the Community.

The principle of Design for Evolution focuses on the evidence that the dynamic nature of the CoP is the key to its evolution. Therefore, the CoP should be seen and thought of a structure that evolves and not as a structure that imposes itself.

The second principle – Open a Dialog Between Inside and Outside Perspectives – means that the design of the CoP does not define the knowledge that will be produced or what its scope is. Its members are the ones who know what knowledge is important to share, which are the challenges to face and what is the potential of certain ideas or techniques.

Regarding the Invite Different Levels of Participation principle, it emphasizes that there are different levels of participation within a CoP, and that all of them should be encouraged to participate: 1) the core group; 2) the active group; 3) the remaining members. The aim should be to create proper conditions for the less active members to be involved in activities, leading momentarily if they wish to.

The fourth principle is to Develop Both Public and Private Community Spaces, through which the authors argue that the CoP should communicate with the exterior, developing activities on public spaces (face-to-face or virtual, formal or informal) as well as on private spaces.

Concerning Focus on Value, it highlights the importance of promoting events, activities and relationships that help the potential value of an emerging CoP rather than trying to determine what that value is.

Combine Familiarity and Excitement is another important principle to sustain a CoP, since it should be a "place" where its members feel "at home", comfortable, and where they do not feel the constraints and pressures of the workplace. They should be able to feel comfortable to ask questions, share ideas and obtain advice without feeling the obligation to follow them.

The last principle mentioned by the authors is to Create a Rhythm for the Community, emphasizing the unique character of each community and, therefore, that each one should find the right rhythm for its phases of development.

3 Research Methodology

The current project is being developed from a design-based research (DBR) approach in order to develop an online CoP in the scope of ESD. A DBR approach outlines that it is important to integrate known and hypothetical design principles with technological advances to provide possible solutions to real contexts in collaboration with practitioners (Wang & Hannafin, 2005). According to Amiel & Reeves (2008), the DBR approach implies conducting rigorous and reflective research in order to develop innovative learning environments, as well as to define new design principles (Figure 1).

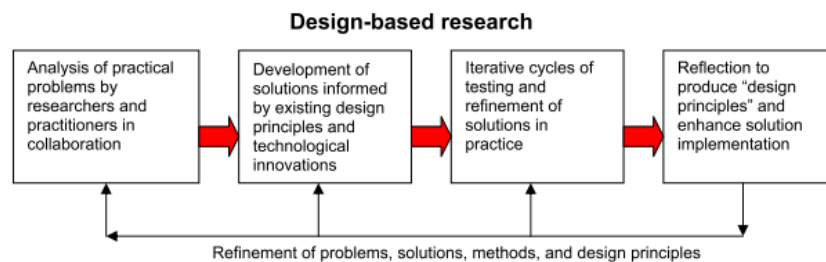


Figure 1. Design-Based Research approach. Adapted from (Amiel & Reeves, 2008, p. 34).

The outcomes of DBR are a set of empirically derived design principles or guidelines that can be implemented by others interested in studying similar settings and concerns. While the ultimate objective is the development of theory, this might only occur after long-term engagement and multiple design investigations. DBR emphasizes that data should be collected systematically in order to re-define the problems, possible solutions, and the principles that might best address them. As data is re-examined and reflected upon, new designs are created and implemented, producing a continuous cycle of design-reflection-design (Amiel & Reeves, 2008).

In this context, the project aims to develop and sustain a CoP for ESD in the Portuguese context. This aim will be achieved through the collaboration of researchers in order to prepare a storyboard for the platform that will serve as a support for the CoP.

In a first research phase, a focus group interview, with several open-ended questions, was implemented with a group of national researchers. These researchers have different competences in research and development of projects in the scope of ESD and CoP. The purpose of this interview was to collect the researchers' perceptions about which principles could help develop and sustain a CoP in the scope of ESD. Data analysis was made through content analysis of the researchers' answers, triangulating them with the literature review. This paper presents and discusses the results that emerged in the first phase that will be presented in the following section.

4 Results and Discussion

Results will be presented and discussed based on the relationship of the principles of ESD (section 2.1) (UNESCO, 2011) and the principles of CoP development (section 2.2.1) put forth by Wenger *et al.* (2002), considering that it would be essential to keep them under attention during the construction of the CoP storyboard (see Fig. 2).

		Principles for Cultivating CoP						
		a. Design for evolution	b. Dialogue with outside	c. Levels of participation	d. Public and private spaces	e. Focus on value	f. Familiarity and excitement	g. Rhythm
ESD principles	I. Collaboration and dialogue							
	II. Engage the 'whole system'							
	III. Innovate curriculum and teaching and learning experiences							
	IV. Active and participatory learning							

Figure 2. Relationship between principles of ESD (UNESCO, 2011) and of Wenger *et al.* (2002).

I – “Collaboration and dialogue”

This EDS principle (I) emphasizes the importance of collaborative and learning partnerships, as well as problem-solving capacity between members of the educational community. This could be achieved through processes which enable debates and activities within the community (UNESCO, 2011).

This principle could be related with two of Wenger *et al.* (2002) principles: “Develop Both Public and Private Community Spaces” and “Combine Familiarity and Excitement”. These were also stressed by the researchers interviewed.

I.d – “Collaboration and dialogue” \wedge “Develop Both Public and Private Community Spaces”

According to Wenger *et al.* (2002) and UNESCO (UNESCO, 2011), the CoP should not be too closed in itself; members must communicate with the outside in order to diversify CoP's sources of information and knowledge and increase problem-solving capacity. In this way, researcher A points out that “it is interesting to proceed with a project and, eventually, even as an aggregator of other resources and other platforms that currently exist on the same theme and that somehow could enrich what could be a new platform”. It is necessary to stress the importance of having an opening to other spaces where the community can find new information and enrich the knowledge within the community.

I.f – “Collaboration and dialogue” \wedge “Combine Familiarity and Excitement”

For the sustainability of a community it is necessary to offer a pleasant environment, diverse in terms of activities, strategies and resources (UNESCO, 2011; E. Wenger, *et al.*, 2002). In accordance with these authors, researcher C points “that it is essential to promote an environment where people feel completely free to expose what they do.” With a community based on teacher training, researchers agree that meeting in person is essential for the

development of a sense of community, belonging and trust. In addition, the researchers emphasize the importance of providing teachers' support, especially grounded on feedback processes. Researchers E and B stress that the support must be made with continuous monitoring, with a clear identification of the learning goals of the CoP. Researcher E also emphasizes that it "must have feedback and support to enable them to make qualitative conceptual leaps".

II – “Engage the whole system”

It is also considered as an ESD principle (β) to “engage the whole system” (schools, families, local agents, government institutions, NGOs, and teacher education institutions) in order to integrate the ESD dimensions on the teaching and learning process. UNESCO reinforces the need to give “attention to not only specific learning approaches and techniques used within education but also to the professional and management processes adopted across educational systems themselves” (UNESCO, 2011, p. 22). This principle could be related with two of Wenger *et al.* (2002) principles: “Design for evolution” and “Open a Dialogue Between Inside and Outside Perspectives”, once again also stressed by the researchers interviewed.

II.a – “Engage the whole system” \wedge “Design for evolution”

In the context of these two principles, researcher A states "initially it was important to moderate the community, in order to guarantee the maintenance of its original idea. When the community is stable, it could then be opened for other members to assume the moderation role". Researcher E, an expert in science education and ESD, agrees and adds, “the ESD scope justifies the participation of all. And all are students, parents, researchers, educators, organizations”.

According to the ESD orientation, it is interesting to involve professionals from different disciplines to promote trans-disciplinary approaches, a guideline that UNESCO (2009) emphasizes. However, researchers agree that there should be different grades and levels to access the platform. The leadership, dynamics, interactions and roles the members assume are essential to its sustainability (2004) and to engage the whole system.

II.b – “Engage the whole system” \wedge “Open a Dialogue Between Inside and Outside Perspectives”

According to Wenger *et al.* (2002, p. 54), is necessary the existence of exchange of dialogue “between inside and outside perspectives” during the CoP evolution for strengthening their life. Thus, it is relevant to invite members from outside the community to develop activities among members on topics related to ESD. Considering the ESD need for a holistic knowledge approach, researcher B considers important to “gather at first people and elements of different areas and with diverse knowledge of reality”.

Another relevant aspect towards the involvement of the whole system is stressed by researcher B, a specialist in ESD, that considers that teacher training and support for teachers' practices is essential to make the ESD orientation a reality in Portuguese schools. To make it possible it is necessary to engage teacher education institutions to promote training and consulting to support the promotion of autonomy in the process of evolution of the CoP and the adoption of practices more consistent with an ESD orientation.

III – “Innovate curriculum and teaching and learning experiences”

Considering the educational shifts proposed by ESD previously mentioned in section 2.1 of this study it is essential to innovate the curriculum and the teaching and learning

experiences. This innovation allows promoting critical thinking and active engagement of the learner. This principle (γ) could be related with two of Wenger *et al.* (2002) principles: “Focus on Value” and “Combine Familiarity and Excitement”, again stressed by the researchers interviewed.

III.e – “Innovate curriculum and teaching and learning experiences” ∧ “Focus on Value”

Considering that the proposal to construct this community is to contribute towards promoting an ESD orientation in Portuguese education, the value focuses on this approach itself and on how it can be promoted. In this context, researcher B points out that “the key to the ESD approach implementation is really this monitoring, it is the support, the training, and not the resources or the strategies themselves [referring to the platform]”. And the researcher reinforces that “teacher training for ESD implementation is a very important issue, and it is perhaps the key”.

At this point all researchers agree that the development and offer of training and consulting will add additional value to the CoP. The original value of this platform is, in fact, giving “support to training, and the training itself could boost the platform” (researcher D, specialized in research and development projects in the educational and business contexts).

IV – “Active and participatory learning”

This principle emphasizes the importance of encouraging active and participatory learning processes in the educational system (UNESCO, 2011). To achieve an active learning it's necessary to develop diversified strategies that improve cognitive skills and attitudes' change, instead of focusing only on knowledge transmission. This principle could be related with two of Wenger *et al.* (2002) principles: “Invite Different Levels of Participation”, “Combine Familiarity and Excitement” and “Create a Rhythm for the Community”, and once more stressed by the researchers interviewed.

IV.c – “Active and participatory learning” ∧ “Invite Different Levels of Participation”

A CoP that involves different participants, with different interests, needs and skills, raises different levels of involvement. According to Wenger *et al.* (2002), this process is natural, although it must be desirable that all members participate equally, through the promotion of an active and participatory learning (UNESCO, 2011). During the participatory process it is important to consider the leadership role. In this context, for researcher A, the community's sustainability “will depend directly on the interactions that take place internally and the distribution of leaderships. Leaders may not appear even as part of the initial leaders' core, but can give them continuity”.

The researchers identified the importance of establishing a Core Group to coordinate the CoP. Researcher D argues that “the success of this community is possible by creating a nucleus of coordination. [...] And this leadership within the training itself will emerge”. Other researchers have addressed this idea indirectly, when reporting that: (i) it would be interesting to “identify persons who were privileged interlocutors, including those that were the subject of a certified initial training that would result in this type of membership and leadership in various school groups.” (Researcher A); (ii) it is necessary to define “the coordinators' role and what they do. There could exist several coordinators and several people to foster the interactions, and the interdisciplinary approach should be fostered” (Researcher E), and (iii) based on the experience of a CoP that involved teacher training and that had great longevity, researcher C says that its longevity was achieved because of the

existence of school leaders, where “they were facilitators at various levels, particularly in addressing the difficulties that teachers had in ICT skills”.

IV.f – “Active and participatory learning” \wedge “Combine Familiarity and Excitement”

To promote active and participatory learning is essential to create a level of comfort that encourages to share and discuss ideas (UNESCO, 2011; E. Wenger, et al., 2002). Accordingly, the Focus Group raised the importance of identifying and valuing the needs and interests of teachers to promote more engagement in the CoP. In this context, researcher C emphasized the importance of involving teachers in the process of conception of the proposal of a CoP, asserting that “we need to have access to the people who can give an approximation to reality, and we all here [researchers] do not give it, because we are away from practice”. Researcher C also presents the strategy based on a project approach as a good way to promote active and participatory learning as well as a familiar environment, saying that the sustainability of a CoP depends on “who streamlines the training and the type of proposals that are offered to people – that is the project approach, which permits to meet the needs people have”.

IV.g – “Active and participatory learning” \wedge “Create a Rhythm for the Community”

Each community has its own rhythm, for each stage of development, and there isn't a correct rhythm, a recipe that determines the sustainability for all (E. Wenger, et al., 2002). According to researcher C, in the context of a CoP based on teacher training “we have to go slowly. One has to consider that teachers have different needs. We have teachers who are beginning and those who have experience. Giving answers to all this diversity is very complicated”. And adds that the researcher/trainer has “to begin from what they do, without imposing, and looking to make critical analysis, giving small steps”. Researcher B highlights that “we must start from the members' needs; however, sometimes this is not enough because if they have no knowledge they do not even feel the need to change”.

5 CONCLUSION

Considering the current national education panorama, and due to the specificity of the Portuguese teachers' job, an improvement of collaborative work between these practitioners (2002) is required in order to promote ESD projects (UNESCO, 2011). Furthermore, an urgent, profound and reflective change is also required from teachers at the level of their practices (Nóvoa, 2009). In this context the need for a more active intervention and guidance is identified, in order to make teaching practices more consistent with the ESD approach.

From the Focus Group discussion, the researchers gave greater prominence to specific key ideas. In order to innovate, the CoP should be supported with the provision of teacher training and consultancy services, offering contextualized support to the teachers at their own schools. It has also been evidenced that at an early stage of implementation of the CoP there should be a pre-defined team responsible for the coordination and promotion of activities. Regarding the CoP leadership, the focus lies in the need, at this early stage of the CoP, to identify teachers that are already leaders in their own schools, and that could be able to take on the leadership of this CoP. However, the researchers also gave prominence to the idea that, during the evolution of the CoP, it is desirable that other members voluntarily appropriate this role in a dynamic process.

Another key idea that emerged was to start small and grow steadily. Considering the CoP openness, it should not be restricted to teachers. Opening the community up to other type of users (researchers, specialists, students, among others), with different possibilities of access and interaction in the CoP, is desirable. Despite what Wenger *et al.* (2002) highlight – that the

CoP should always be open from the beginning –, considering the Portuguese teachers' reality and specifically the lack of culture of collaborative work, this might inhibit their initiative of spontaneously joining and participate in such communities.

The DBR approach recognizes the complexity of interactions between researchers and practitioners (i.e. teachers) that occur in real-world environments and in the contextual limitations of proposed designs. The development of design principles should undergo a series of testing and refinement cycles (Amiel & Reeves, 2008). Therefore, the next step of the project is to identify and engage Portuguese teachers with leadership skills, in order to establish design principles that will help design the learning environment. An interview with identified teachers with leadership skills, from the Center and North of Portugal will be conducted.

References

- Aikenhead, G. S. (2006). *Science education for everyday life: Evidence-based practice*. New York: Teachers College Press.
- Amiel, T., & Reeves, T. (2008). Design-Based Research and Educational Technology: Rethinking Technology and the Research Agenda. *Educational Technology & Society*, 11(4), 29-40.
- Anderson, T. (2004). Teaching in an online learning context. In A. Press (Ed.), *Theory and practice of online learning* (pp. 273-294). Edmonton.
- Hildreth, P. M., & Kimble, C. (2004). *Knowledge networks: Innovation through communities of practice*. York: IGI Global.
- Lave, J., & Wenger, E. (1996). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.
- Martins, T. (2007). Concepção de uma Comunidade de Prática online: um estudo em torno da integração das TIC na disciplina de EVT (pp. 318). Aveiro: University of Aveiro.
- Nóvoa, A. (2009). *Professores: imagens do futuro presente*. Lisboa: Educa.
- Sá, P. (2008). Educação para o desenvolvimento sustentável no 1º CEB contributos da formação de professores. Aveiro: Universidade de Aveiro.
- Shulman, L., & Shulman, J. (2004). How and what teachers learn: A shifting perspective. *Journal of Curriculum Studies*, 36(2), 257-271.
- UNESCO. (2005). *Draft International Implementation Scheme for the UN Decade of Education for Sustainable Development*. Paris: UNESCO.
- UNESCO. (2009). *Review of Contexts and Structures for Education for Sustainable Development*. Paris: UNESCO.
- UNESCO. (2011). *Education for Sustainable Development: An Expert Review of Processes and Learning*. Paris: Unesco.
- United Nations. (2005). UNECE strategy for education for sustainable development. Vilnius: Economic and Social Council.

- Wang, F., & Hannafin, M. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development*, 53(4), 5-23. doi: 10.1007/bf02504682
- Wenger. (2000). Communities of practice and social learning systems. *Organization*, 7(2), 225.
- Wenger, E. (1999). *Communities of practice: Learning, meaning, and identity*. Cambridge: Cambridge Univ Press.
- Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Boston: Harvard Business Press.